Ueber Beziehungen zwischen Farben und Tönen. Prof. PIETRO ALBERTONI. Originalmittheilung, Centralbl. f. Physiol. No. 15, 26 Oct. 1889.

Drawing parallels between color and tone has been a tempting occupation to many people. Hauth for example assumes three primary colors, blue, yellow and red, and over against them three primary tones *c* (*do*), *e* (*mi*), *g* (*sol*). Prof. Albertoni has, he believes, found clinical evidence for something of the kind in the case of three color-blind persons. Two were red-blind and failed to distinguish *g* (*sol*); and one was green-blind and failed to distinguish *d* (*re*). The persons tested were of musical ear, and their failure to perceive these tones consisted in inability to distinguish them from neighboring tones on the piano and to sing them accurately when they were given. Some persons not red-blind were also found who could not produce *g* (*sol*), but whether from failure of perception or of voice mechanism does not certainly appear. For the first cases Albertoni proposes the name "auditory daltonism." [The natural comment on these observations is: Interesting, but in need of confirmation. It is not impossible that tone-deafness may be found more frequently in the color-blind; but what is to be said of its correspondence with the three-color Young-Helmholtz theory which seems now on the point of collapse? REV.] E. C. S.

Studien über die elementaren Farbenempfindungen. Erster Abschnitt. FRITHIOF HOLMGREN. Skandinavisches Archiv für Physiologie, Bd. I, H. 1-3, 1889.

Finding himself definitely prevented from completing his studies, in large measure because of the eye-strain entailed by them, Prof. Holmgren is compelled to give his researches to the public, if at all, in their present incomplete condition. He is further urged to publication by the criticisms, both theoretical and experimental, which the preliminary accounts of his work have drawn from Hering (*Pflüger's Archiv*, Bd. xl, 1,) and Isaachsen (*Ibid.*, Bd. xliii, 289). His line of experiment was this, namely, to bring upon the retina a point of light fine enough to stimulate the visual elements singly, and thus call out the three fundamental sensations which should result according to the Young-Helmholtz theory. This first paper is devoted to the statement of the problem, to the preliminary experiments, and the choice and management of the apparatus. The experiment, if it can be generally verified, is one of such great importance for the theory of color vision, that the continuation of Holmgren's account of it will be looked for with interest. Incidentally, the author observed a very interesting instance of the effect of muscular sensations upon vision. In looking at his very faint and fine points of light with eyes somewhat elevated (the same thing, he says, may be seen on looking with the eyes in that position at a gas flame turned down to the faintest blue), the image seems to move constantly upward or in the direction of the muscular exertion—that is, the sensation of continued tension expresses itself in the illusion of continued motion. E. C. S.

Ueber Nachbilder im Binocularen Sehen und die binocularen Farbenerscheinungen überhaupt. H. EBBINGHAUS. Pflüger's Archiv XLVI, pp. 498-508.

Ebbinghaus describes a simple phenomenon in the subject of after-images that seems to have been hitherto overlooked. The left eye, say, looks at a bit of bright paper an a dark ground, while the other eye, being open, is prevented from seeing it by a piece of card-board. On suddenly shutting the left eye, a *positive* after-image is seen by the right eye on the piece of card-board. It is certain, Ebbinghaus thinks that this after-image is due to the right eye, because the circumstances

are not such as to cause a *positive* after-image in the left eye, that being caused only by a relatively bright light or in a well-rested eye. In the given circumstances, it cannot be detected with the right eye closed. Moreover, this after-image can be got, though with more difficulty, even if the left eye is kept open, provided the bit of bright paper is cut off by a piece of card-board; but these are conditions under which, according to all that we know about after-images, only negative ones can arise in the affected eye. Ebbinghaus does not suppose that in this phenomenon an actual effect is produced in the right retina, but rather that it is due to central processes; and in supposing this he does not consider that the well-founded belief that ordinary after-images are peripheral is at all affected.

The hypothesis that an excitation of one eye produces an effect in (at least the central attachments of) the other eye, Ebbinghaus considers is borne out by other facts. In binocular color-mixing, *two* colors are produced which succeed each other by rivalry; even when the colors mixed are nearly alike and the composed color looks like one, it will be found, on trying to match it with pigments, that it is really two. Ebbinghaus' hypothesis here is that the two eyes see two distinct images, A and B, and at the same time two faint, sympathetic images, *b* and *a*; and that rivalry takes place between the fused pairs, *A*, *b* and *B*, *a*, the color of the mixture thus leaning now towards one and now towards the other of the component colors. [This is the same thing as saying that a real *binocular fusion*, in the original meaning of the phrase, does not take place at all.] A similar explanation is applied by Ebbinghaus to binocular contrast.

The new phenomenon described is difficult to get and Ebbinghaus recommends trying it, for the first time, after a sleepless night.

C. L. F.

Optische Urtheilstäuschungen. Dr. F. C. MÜLLER-LYER. DuBois-Reymond's Archiv. Supplement Band, 1889.

The interesting illusions described and explained in this article are difficult to understand without the accompanying illustrations. If we draw an acute angle and an obtuse angle with equal sides, the sides of the latter will seem very much longer than the sides of the former, and this effect will be the more marked the greater the difference in the two angles. Again, draw a pair of such angles and connect their apices by a straight line, and the straight line connecting the obtuse angles will seem longer than the one connecting the acute angles, that is, provided the sides of the angles are directed towards the connecting line; if they are directed away from this line, then the line connecting the acute angles seems the longer, and the contrast becomes strongest in comparing two lines connecting pairs of acute angles, alike in the size of the angle and the length of the sides, but the one directed towards, and the other away from the connecting line. The same illusion appears in various forms: the sides of a triangle seem smaller than the sides of a square, though really the same; and the sides of the square will seem shorter than the equally long sides of a pentagon or hexagon, and so on. The general principle of explanation is, that the more contracted the suggested environment of the space-dimension in question, the smaller will it seem. This explains at once why the sides of acute angles seem shorter than those of obtuse ones, why lines with contracting angles or curves seem shorter than lines with expanding outlines at their extremities; why a space between two narrow oblongs seems larger than the same space between two squares, or a distance on a line marked off between two short lines seems longer than the same distance marked off between two longer lines, and so on. It is also to be noted that these illusions differ from the ordinary effects of contrast in that